VIGO COUNTY

INDIANA

Its Shales and Clays

TERRE HAUTE

"The Pittsburgh of the West"

WM. B. BURFORD PRINT, IND'PLS.

Terre Haute's Advantages

- Population—60,000
- Schools—21
- Steam railroads—11
- Passenger trains—80 every day
- Electric lines—City 21 miles
- Interurbans—Two in operation
- Distances from large cities—
  - Chicago, 178 miles
  - St. Louis, 168 miles
  - Cincinnati, 182 miles
  - Louisville, 161 miles
  - Indianapolis, 73 miles
- Water facilities—Wabash river
- One-half population of United States in radius of four hundred miles. Population of two hundred and fifty thousand in radius of thirty miles
- Manufacturing industries—213, employing fourteen thousand
- Coal center of Indiana.

VIGO COUNTY

Vigo County, in which the city of Terre Haute is situated, lies on the western border of Indiana, about midway between the north and south boundary lines of the State. It is almost quadrangular in shape, but as the Wabash River forms its southwestern border, the area of this portion is from one to five miles wider than the center. The county has an extent of 24 miles

Extracted from "The Clays and Clay Industries of Indiana," by W. S. Blatchley—Pages 130-175 of the 29th Annual Report of the Department of Geology and Natural Resources of Indiana, 1904.

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"The Wabash River flows southwesterly through the county, so that about one-fifth of the area of the latter lies west and four-fifths east of the river. The immediate valley of the river is from four to five miles wide, occupying about one-fourth the area of the county. The river, at the ordinary stage of water, has an average width of about 600 feet. Low water at Terre Haute, near the middle of township 12 north, is about 445 feet above sea level. The river and its flood plain occupy the western third of the valley, the eastern portion being a broad terrace. The flood plain or first bottoms rise from 14 to 20 feet above low water in the river, while limited areas of 'second bottoms' rise from 10 to 15 feet above the flood plain. The terrace on the east rises from 50 to 75 feet above low water in the river, but toward the south, in Prairie Creek Township, it merges into the flood plain."*

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*Scovell, 21st Ann. Rep. Ind. Dep. Geol. and Nat. Res., 1896, p. 507.

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The surface rocks of the county belong wholly to the Coal Measures Epoch of the Carboniferous Period, and are comprised of alternating layers of sandstone, shales, coals and under-clays, with an occasional thin stratum of limestone. These surface rocks are everywhere, except along the larger streams, covered either by a thick layer of drift or, in the stream valleys, by alluvium.

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The highlands on either side of the valley have an elevation of from 100 to 200 feet above the river, the bluffs in some cases being quite abrupt. These bluffs form the borders of the uplands, the latter being usually more or less broken by the erosion of small streams. These uplands extend to the confines of the county, and are underlain with coal. With the exception of the recent sedimentary clays of the river bottoms, all the commercial clays of the county are found in the uplands, or outcropping along the hillsides where the river terraces meet the uplands.

"The greater part of the county is drained by the Wabash and its tributaries. The principal streams from the west are Brouillet's Creek, Coal Creek, Sugar Creek (with several large branches), Clear Creek and Hawk Creek. These streams rise in Illinois and flow southeasterly into the river through valleys from one-quarter to a half mile wide and from 30 to 80 feet in depth. The streams from the east are Otter Creek, Lost Creek, Honey Creek, Prairie Creek, Turman's Creek and Busseron Creek. Portions of Pierson and Riley townships are drained to the southeast by Splunge Creek into Eel River. The valleys of the river and its tributaries seem to be the channels of an earlier drainage system that have been partly filled with sand and gravel, so that in many cases the beds of the present streams are from 25 to 100 feet above the rocky beds of the older channels. These smaller streams are, for much of the summer, 'lost creeks,' a fairly good stream among the hills disappearing in the sands and gravels of the main valley."*

In Vigo County the conditions are especially favorable for successful coal mining; for the growing of grain and market garden products, for stock raising and for many forms of manufacturing. The clay industries along the west bluffs of the Wabash have developed rapidly in the past five years, and there is little doubt but that the county will soon become one of the great clay industrial centers of Indiana.

Due mainly to the work of an energetic commercial club, Terre Haute in the past two years has grown very rapidly, and her population is now very near, if not beyond, the 50,000 mark. Her transportation facilities can not be excelled for a city of that size, as no less than ten different railways either pass through or have their terminals within her limits. These are the St. Louis Division of the Big Four, and the main Division of the Vandalia, both of which pass east and west through the city and the full width of the county; the Peoria Division of the Vandalia, running northwest to Peoria, Illinois; the T., H. and L. Division of the Vandalia, northeast to Logansport and South Bend; two of the main divisions of the C. & E. I., running northwest and northeast; the E. & T. H., running south; the E. I. and the Southern Indiana to the southeast, and the Chicago Division of the Southern Indiana to the northwest. Connecting all of these is a belt railway passing nearly around the city, while electric interurban lines extend east, north and west and add to the traffic facilities.

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*Scovell, Loc. cit., p. 508.

Township 13 North, Ranges 8, 9 and 10 West, and Part of 7 West.

With the exception of the Wabash terrace or second bottom, in the west half of 8 west and the east half of 9 west, this northern tier of townships in Vigo County is, in general, a rugged region, much broken and cut up by surface streams. Coal VI has its eastern outcrop near Coal Bluff; while coal VII in this area occurs only west of the Wabash River and in a small area about Atherton. In the area covered by coal VI, sandy shales or shaly sandstones predominate close to the surface, the layers of workable clayey shales being few.

One mile northeast of Coal Bluff, in the southeast quarter of section 5 (13 north, 7 west), a drilling near the Gladstone mine showed the following strata between the surface and the underclays below coal IV:

Part of Section Near Gladstone Mine, Northeast of Coal Bluff.

		Feet.	Inches.
1.	Coal Va	1	3
2.	White shale	4	5
3.	Blue shale	15	0
4.	Sandstone	10	0
5.	Gray Shale	3	0
	Place of coal V		
6.	Under-clay	7	0
7.	Shale, blue	25	0
8.	Sandstone	7	3
9.	Shale, gray	4	0
10.	Coal IV	4	2
11.	Under-clay	3	0
12.	Shale, blue	10	7

Of the strata passed through, Nos. 2, 3, 6, 7, 11 and 12, aggregating 65 feet in vertical thickness can, if necessary, be used for clay products, and show a plentiful supply of clay working materials in this area. Railway facilities are excellent, as both the C. & E. I. and the Big Four have spurs penetrating this region.

One mile southeast of Coal Bluff, on the land of James Kessel, G. W. Eppert and Leonard Carter, in the south half of section 17 (13 N., 17 W.), a fair quality of potters' clay occurs in the valley of a small stream. The clay is exposed at several places in the bed of the stream, and test bores have shown it to be from six to 10 feet thick, and overlain with one to four feet of soil and gravel. The bottom of the stream valley is about 250 feet in width, and 25 feet below the level of the surrounding region; the clay occurring at the depth mentioned over five to six acres in this bottom. It is very probably the partially exposed and weathered under-clay of coal VI, which is found seven feet four inches thick, at a depth of 28 feet below the top of the hills on either side of the valley. The clay is a very white, fine grained, plastic material. It has been tested at Gas City and Brazil potteries and found to make a good grade of stoneware, its only drawback being that it has a tendency to stick to the molds.

The strata accompanying coal VII occur in the vicinity of Atherton, sections 6 (13 north, 8 west), and 1 (13 north, 9 west), and it is very probable that the overlying blue shales will be found in quantity in these two sections, but no record of their occurrence is at hand.

On the west side of the Wabash a switch of the C. & E. I. Railway has recently been extended south from Clinton to Mine No. 6 of the Indiana Fuel Company, on the land of T. Collins, in the northwest quarter of section 16 (13 north, 9 west). The shaft of this mine is in the valley of a small stream, and on the north side of the switch where it turns from the river valley into that of the stream there is an exposure of shale 22 feet thick. This is a soft drab to blue clayey shale of excellent quality for the making of vitrified wares. An occasional nodule of kidney iron ore is visible in the outcrop. This shale forms the greater part of the surface above drainage over a large area in this vicinity, being exposed 35 feet thick, about 150 feet east of the tipple of No. 6 mine. In this shaft coal VII occurs at a depth of 106 feet, the greater part of which is shale.

The Chicago extension of the Southern Indiana Railway is, at this writing, being built up the Coal Creek Valley, through sections 20 and 19 (13 north, 9 west), and 24, 14 and 15 (13 north, 10 west), and when completed will make available for the first time fine beds of shale and veins of coal in the northwestern corner of Vigo County. The spur of the C. & E. I., above mentioned as running south from Clinton on the west side of the Wabash River, has been graded as far south as the Coal Creek Valley. Near the point where this grade strikes the valley, in the northwest quarter of section 28 (13 north, 9 west), occurs a fine outcrop of shale. This exposure is best seen on the north side of a roadway, which runs east and west on the north side of Coal Creek Valley. Here it rises 15 or more feet above the level of the roadway, and is a soft, gray to blue clayey material. At a point 20 feet higher on the hill and 200 yards back from the valley the shale is overlain with sandstone. If the C. & E. I. extension be completed this deposit of shale will be less than an eighth of a mile north of its junction with the Chicago Division of the Southern Indiana, this junction being on the south side of Coal Creek Valley at the point where the latter merges into the Wabash River Valley.

Farther north thick beds of the shale overlying coal VII outcrop at a number of localities. At Durkey's Ferry, in the northwest quarter of section 21 (13 N., 9 W.), it is 18 feet thick and contains many ironstone nodules, some of which, when split open, disclose very fine impressions of fossil plants.

A general section of the Coal Creek Valley from the junction of its forks in the northwest quarter of section 23 (13 north, 10 west), to its point of mergence with the Wabash River Valley, would show the strata to be about as follows:

Section Along the South Side of Coal Creek Valley.

		Feet.	*Inches.*
1.	Surface and boulder clay	8	0
2.	Brown sandy shale	1	3
3.	Drab to blue clayey shale with scattered ironstone nodules	30	0
4.	Dark gray fossiliferous limestone	2	6
5.	Black sheety bituminous shale	1	2
6.	Coal VIIIa	1	0
7.	Under-clay fine drab	4	6
8.	Shale, gray to blue, with one or two bands of ironstone near its base	53	0
9.	Coal VIII	4	8
10.	Under-clay	7	0
11.	Solid buff to gray limestone	3	6
12.	Gray sandy shale	6	0
13.	Sandstone, massive buff to gray	9	0
14.	Shale, drab to buff	16+	0

In the southeast corner of section 19, just west of the "Coal Creek Hill" on the gravel road, there are exposures of a fine clay shale in the ravines on the south side of the creek. Coal VIII has been stripped a half mile farther up the creek, and the shale outcrops mentioned are those of No. 8 of the general section, above the level of that stripping. The exposures are at the base of the shale deposit, the upper portion being covered with weathered shale and other material, so that the exact thickness of the shale at this point could not be ascertained, but it is evidently more than 40 feet. This deposit is not over 200 yards from the new Chicago and Southern Indiana Railway, with a good terrace or second bottom between for a factory site. Coals VII and VI, both of workable thickness, can be mined from below the shale, so that the site is one well worth the attention of prospective clay manufacturers.

On the north side of the creek at this point the sandy shale and sandstone, Nos. 12 and 13 of the section, outcrop 15 feet above the bed of the stream, just west of the bridge.

On the land of G. W. Leek, in the southwest quarter of section 19 (13 north, 9 west), the bed of the creek is just above coal VIII, which has here been stripped in a number of places. Near this point shale No. 8, 30 to 40 feet thick, outcrops in bold bluffs on the south side of the creek. On the north side, along the grade of the railway, the shale is, in general, covered with drift and weathered material, two to six feet in thickness; the bed of shale itself running thinner, but averaging 18 to 25 feet.

The Coal Creek Coal Company owns in fee simple, or has under lease, about 1,800 acres of land along this valley, and controls the finest deposits of exposed shale. One of the most available of these is on the south side of Coal Creek, on the southeast quarter of section 23 (13 north, 10 west). At this point the base of shale No. 3 outcrops 15 feet above the level of the stream, with black shale and a thin layer of coal VIIIa, below it. In September, 1904, an old abandoned cornfield occupied 20 to 30 acres of the slope of the hill above the shale outcrop. In this in many places the shale came to within two or three inches of the surface, so that no stripping would be necessary. The bed of shale will here run 20 to 30 feet in thickness, and is of a soft, gritless, very plastic material, suitable in the highest degree for vitrified wares of many kinds. The grade of the railway is about 200 yards to the north, and coals VIII, VII and VI, all of workable thickness, occur beneath the shale deposit. A dam across the stream will conserve water enough for all purposes or, if necessity required, it could be secured from deep wells or piped from the Wabash River. One-fourth mile below this, also on the south side of the creek, in the southwest quarter of section 24, shale No. 8 outcrops 30 feet thick, with a layer of ironstone boulders in its lower third.

On the B. Swafford land, in the east half of section 15 (13 north, 10 west), there is a bluff of shale 25 or more feet in vertical thickness, exposed along Coal Creek. The line of the Chicago Division of the Southern Indiana Railway passes within a quarter of a mile of this outcrop.

Just above the junction of the two forks of Coal Creek, in the northeast of the northwest of section 23, the Coal Creek Coal Company owns 80 acres. On it the old shaft of the Eddington and Vermillion mine passed through the following strata:

Section of Eddington and Vermillion Shaft.

		Feet.	Inches.
1.	Shale, light colored, fine quality	5	0
2.	Limestone, impure and shaly	0	6
3.	Coal VIIIa	0	8
4.	Shale, of good quality	34	0
5.	Limestone, clayey	8	0
6.	Shale	34	0
7.	Coal VIII	4	8

Outcrops of both shale and under-clay occur in numerous other places in the Coal Creek Valley, but the above are all of which I have especial record. There is little doubt but that in a few years this region will be found a close second to West Terre Haute in the clay manufacturing business.

Township 12 North, Ranges 8, 9 and 10 West.

East of the Wabash River there are but few beds of good available clay material in this area. While coal VII occurs over much of the region, it is too close to the surface to have much shale above it, and that between it and coal VI is, in general, too sandy for clay wares. At Seeleyville the section exposed in the shaft of the "Ray" mine of the Vigo County Coal Company, disclosed 41 feet of sandy shale above the worked seam of coal VI. This contained too high a percentage of silica and mica to be of value. The under-clay of the coal is but 18 inches thick. A lack of time prevented my visiting the mines farther north along the I. & St. L. Railway, but from the records of bores furnished me by the Coal Bluff Mining Company, I should judge the conditions there to be about the same as at Seeleyville.

West of the Wabash River there occur, in the area under consideration, the best known shale deposits of Vigo County, and the only ones which, up to the present, have been developed to any extent. These deposits are found in the bluffs of the Wabash and occur, in the main, just above coal VII, which is the principal worked vein in the area. A connected section along Sugar Creek, made from notes by Dr. J. T. Scovell, and published in the 1898 Coal Report, p. 749, will serve to show the average sequence and thickness of the strata in the upland area west of the river:

General Connected Section Along Sugar Creek.

	Feet.	*Inches.*	*Feet.*	*Inches.*
1. Surface, soil, and clay.......	1	0	1	0
2. Subsoil yellow clay..........	4+	0	5	0
3. Boulder clay	10+	0	15	0
4. Shale	5+	0	20	0
5. Coal VIII	1	4	21	4
6. Fire-clay and shale..........	3	0	24	4
7. Limestone, crystalline fossiliferous	2	0	26	4
8. Shale, light colored to red....	6 to 12	0	38	4
9. Limestone, impure, flinty....	1	0	39	4
10. Sandstone, massive	11	0	50	4
11. Sandstone, merging into shale	14	0	64	4
12. Shale, bluish with ironstones in upper part.............	28	6	92	10
13. Bone coal and sheety shale..	1	0	93	10
14. Coal VII	4	8	98	6
15. Fire-clay	10	0	108	6

As shown by the above section, coal VIII, stripped on Coal Creek, has been reduced in this area until it is not workable. Below it are commonly found the two beds of limestone from five to 12 feet apart, and below these sandstone and shale to coal VII. The following extracts from Mr. Scovell's descriptions of the strata between coals VIII and VII may be taken as a general description of this area and the strata mentioned in the above section:

"The fire-clay and shale (Nos. 4 and 6) on Coal Creek and northward are from six to 10 feet in thickness. Toward the south the variation in thickness is through a wider range. In every place that I have been able to examine this material it has been a fine clay shale, free from grit. In a bluff on Coal Creek, on the southwest of the northwest of section 28—12—9, in the lower part of this shale, there is a thin layer of fine-grained, siliceous rock, about one foot in thickness. It is light brown in color and is traversed by tubes of varying size, that possibly may have been worm tubes. It seems to be of limited extent.

"The limestone No. 7, along Coal Creek and northward, is flinty and nodular, often brittle, and breaking with a conchoidal fracture. Toward the south this limestone becomes a hard, somewhat crystalline rock, from two to three feet thick. The shale No. 9, below this limestone, is from three to 12 feet thick, resting usually on limestone below. This is a fine clay shale, generally free from impurity of any kind, but sometimes it is seamed with limestone, sometimes it is reddish or bluish, sometimes white or gray.

"In Fayette township, where examined, it was of a light color. On section 23 (12 north, 10 west), and on the southwest quarter of section 11 (11 north, 10 west), it is light colored, but on the south half of section 25 (12 north, 10 west), and on the east half of section 15 (11 north, 10 west), and at other places it is highly colored, but always of a fine quality. Near the center of section 23 (12 north, 10 west), the two limestones outcrop in the bank of Sugar Creek, and are separated by 12 feet of this valuable shale. But about a quarter of a mile west the limestones outcrop again, with not more than three feet of shale between them, and this containing quantities of limestone, generally in boulders.

"The lower limestone, No. 9, varies greatly. In the southern part of the county it is seldom as thick and never of as good quality as the upper one, and is called by the miners 'bastard limestone.' As it forms a thin layer over the sandstone below, they sometimes fail to recognize it as a limestone.

"The sandstone below this limestone is sometimes massive and of uniform texture, forming a good quarry stone, as on the southwest quarter of section 28, northwest of 28, and the southwest quarter of 16 (13 north, 9 west), but towards the south it is fragile and shaly. It merges into the sandy shale, No. 11, which sometimes has a peculiar wavy structure. These sandy shales merge into the fine clay shales, No. 12, below, so that it is difficult to say how much there is of either of the three strata below the limestone. Perhaps the following section on section 24 (12 north, 10 west), will be about an average. Sandstone, 12 feet; sandy shale, 10 feet; clay shale, 30 feet."*

One-half mile northwest of West Terre Haute, and just north of the point where the Vandalia Railway strikes the upland, is a tract of fine shale covered land, to which special attention was called in the 1895 clay report. In 1901 the Vigo Clay Company purchased 143 acres of this tract in the northwest quarter of section 19 (12 north, 9 west), and on it, about 50 rods north of the railway, erected a large plant for the making of hollow brick, fireproofing and kindred vitrified products from the shale No. 12. At the point where opened, the shale was covered only by drift material, a section of the pit in June, 1904, showing as follows:

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*The Geology of Vigo County, in 21st Ann. Rep. Ind. Dep. Geol. and Nat. Res., 1896, pp. 531, 532.

Section of Clay Pit of Vigo Clay Company.

		Feet.	Inches.
1.	Soil and gravel (stripped)	1	8
2.	Yellow clay and decomposed shale, stained by oxide of iron	7	0
3.	Blue shale	18	0
4.	Ironstone band	1	4
5.	Gray shale containing numerous particles of pyrites of iron	13	0
6.	Coal VII	5	6
7.	Under-clay	8	0

Of the above, Nos. 2 and 3 were being mixed and used in the proportion in which they occur. The iron pyrites in the lower grade shale strata, No. 5, had caused the abandonment of that portion of the pit. A separate coal shaft led down to the coal mined for fuel. Wares made from the under-clay No. 7 alone were found too difficult to dry. Mixed with the shale, in the proportion of one part to two, it made a fine product, but as some difficulty had been experienced in getting it intimately mixed, and as the shale occurs in plentiful quality, the under-clay was not, at the time, being utilized.

The mining of the shale in the pit is let by contract at 12½ cents per car holding a cubic yard. About 100 cars are used daily, being elevated by steam power to the dump above the dry pan.

Water in abundance for this factory and the other three factories north is secured from the old Vandalia gravel pit, about a third of a mile to the east. The hollow brick and other wares made by the company are easily and cheaply burned, of excellent quality, and have a wide sale. The company has been very successful from the beginning, having been far behind in their orders for most of the time during the three years their factory has been in operation. Some trouble is experienced with shrinkage, as the raw material is very "fat" or plastic. The addition of a small percentage of silica or ground sandstone would, doubtless, be of benefit. Eight or nine men are employed in mining the coal for fuel. The coal contains quite a quantity of sulphur balls, which are separated, cleaned of attached coal and sold at $3.00 per ton f. o. b. at the factory.

Just north of the plant of the Vigo Clay Company is that of the C. M. Miller Mining and Manufacturing Company, erected in 1904 for the purpose of making ordinary brick. Their clays are, for the most part, purchased from the Vigo Clay Company, being alluvial or river bottom clays obtained from the low ground about a quarter of a mile east and hauled in wagons to the plant.

One-third of a mile farther north, on the southeast quarter of the northeast quarter of section 18 (12 north, 9 west), the National Drain Tile Company erected one of their four Indiana plants in 1902, and began the making of drain tile in February, 1903, from the No. 12 shale. The factory is on a narrow terrace or second bottom of the Wabash Valley on the east side of the St. Mary's road, and about 150 yards east of the east border of the upland. Several switches of the Vandalia run to each of the clay factories along this terrace, the Big Four just to the north, and much the nearer to two of them, having, for some unaccountable reason, failed to put in a spur. The pit of this company is just north of the plant, and shows three to six feet of brownish yellow decomposed shale, with 12 to 16 feet of blue shale beneath. This material is worked down to the black sheety shale, four to ten inches of which occur just above coal VII. The latter is not, as yet, mined, but a slope shaft will be put in as soon as the clay pit has been opened a little deeper. The mining of the shale is let by contract at 32 cents per car holding two cubic yards, delivered at the pan. Six men are worked in the pit, five of whom receive an average wage of $1.75 per day. Forty carloads of shale are taken out each day, this quantity being sufficient to make a kiln of tile, which is the daily output of the factory.

Mr. J. F. Morris, the superintendent of this plant, informed me that he had never seen a tile made from this shale deposit crack in drying. The extraordinary quality of the shale for making hollow products is proven by this minimum of loss in drying. He said that at the Summitville plant of the same company, where he formerly worked, the tile are made of drift or surface clay, and when five tile are put in the dry room, an average of but little more than three are taken out in fit condition for burning. The loss by cracking in burning at the Terre Haute plant is small, and it is not the fault of the clay, but of the burner. The tile made at this plant range in size from four to thirty inches, and are shipped to all parts of the Mississippi Valley. A twenty-carload order for Lawrence, Miss., was being loaded at the time of my visit. This plant and the one south of Hillsdale, which uses practically the same material, are the most successful of the four in operation by the company, the demand for the output being at all times in excess of the supply.

The Terre Haute Brick and Pipe Company, in 1893, purchased 100 acres of land two and a half miles northwest of Terre Haute, in the northeast quarter of section 18 (12 N., 9 W.), almost all of which is underlain with shale and coal. Just above the high water mark of the Wabash River, and a few hundred yards south of where the St. Louis Division of the Big Four Railway strikes the uplands, this company erected, in 1894, a modern plant for the making of paving brick, hollow brick and vitrified wares. At this point the shale overlying coal VII comes close to the surface, a section in the pit just west of the factory showing, in August, 1904, as follows:

Section of Clay Pit of Terre Haute Brick and Pipe Company.

	Feet.	*Inches.*
1. Soil and yellow clay	2	6
2. Decomposed brownish yellow shale	4	0
3. Blue clayey shale	14	0

About six inches of the top is removed by scrapers and the remainder mixed as it comes from the pit. The main body of blue shale is a soft, unctuous material, wholly free from grit, and containing fewer kidney iron ore concretions than in the pit of the Vigo Clay Company. In the pit it was seen to lie in laminæ one and a half to four inches in thickness. About 140 cars, holding one and a fourth cubic yards, are used each day to make 40,000 paving brick. The shale is mined for 15 cents per car, but is hoisted by the company, who furnish cars, powder, etc.

The shaft through which the Terre Haute Brick and Pipe Company mine their coal is located in a ravine about one-third of a mile northwest of their brick plant, near the center of their tract of land. Coal VII is mined at a depth of 50 feet. A new air shaft was being completed in August, 1904, which showed:

Section of Air Shaft Near Mine of Terre Haute Brick and Pipe Company.

	Feet.	Inches.
1. Soil and alluvial clay	2	8
2. Shale, light gray	25	0
3. Kidney iron ore or ironstone	1	4
4. Bluish gray clayey shale	22	0
5. Coal VII	4	10
6. Under-clay	10+	0

The upper ten feet of No. 2 shale contains more silica than the lower portion, but when mixed with the latter renders it of better quality for working. The under-clay below the coal is not now being utilized, but will make a good grade of hollow brick or sewer pipe. The coal is hauled to the brick plant in carts and dumped by the side of the kilns. A tramway will eventually be put in for hauling both it and the under-clay. In addition to the land owned in fee simple, the company has under lease the coal and clay on 200 acres to the north.

Just to the west of the land of the Terre Haute Brick and Pipe Company is a 93-acre tract, owned by Hon. Charles Whitcomb, all of which is underlain by the thick bed of No. 12 shale above coal VII. The coal on the tract is being mined, but the shale has not, as yet, been used. It will be found suitable for all kinds of vitrified products and for drain tile, pressed front and ordinary brick.

The same shale will be found beneath the surface of the greater portions of sections 12, 13, 24 and 25 and the west halves of 6, 7, 18 and 19 (12 N., 9 W.).

On the John L. Walsh farm, northeast quarter of 7, the shale is covered to a depth of five or more feet with surface soil and hardpan. The upper 60 feet of a bore drilled 400 feet northwest of the Walsh line, on the estate of the Sisters of Providence, showed the presence of the following strata:

Partial Section of Bore on Land of Sisters of Providence, Near St. Mary's.

		Feet.	*Inches.*	*Feet.*	*Inches.*
1.	Surface	2	0	2	0
2.	Hardpan	15	0	17	0
3.	Under-clay	11	0	28	0
4.	Drab soapstone shale	3	0	31	0
5.	Blue soapstone shale	11	0	42	0
6.	Limestone	1	0	43	0
7.	Sandy shale	7	0	50	0
8.	Limestone	2	6	52	6
9.	Soft gray shale	1	0	53	6
10.	Blue sandstone	1	0	54	6
11.	Blue shale	6	0	60	6

Along West Little Sugar Creek, on the north half of section 15, and in the west half of section 9 (12 N., 10 W.), there is a bluff nearly a mile and a half long, on the lands of M. G. Lee, P. J. Ryan and Joseph Hickling, which is, in the main, composed of an outcrop of shale of good quality. In some places the exposure is 20 feet or more thick. The necessary stripping is variable, averaging about seven feet, and is heavy at no point along the stream. The outcrops are underlain with two or three workable veins of coal, and can be reached by a spur of the Vandalia, a mile or so in length, which can be readily constructed up the valley of the creek.

"A deposit of fine clay on section 22 (12 N., 10 W.), is said to be suitable for encaustic tiling and high-grade pottery wares. A partial analysis of this clay by Dr. W. A. Noyes is as follows:

Silica	50.36	
Alumina	15.08	
Oxide of iron	4.45	
Loss by ignition	13.98	
		83.87
Undertermined substances		16.13
Total		100.00

"Prof. Noyes says that the undetermined substances appear to consist largely of lime. The clay, he thinks, may be of value for earthenware and similar products."*

On the "old Casto" or Thorp farm, in the southeast quarter of section 23 (12 N., 10 W.) is an extensive outcrop of shale No. 8

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*Scovell, Geol. of Vigo Co., 1896, p. 571.

of the general section. This is within one-third of a mile of the Vandalia Railway and by the side of Sugar Creek, in which is found a never-failing supply of water. A vein of coal five feet thick is found at a depth of 50 feet and another at 130 feet. The shale is exposed to a depth of 12 feet, beneath four feet of overlying soil and clay. It is a soft, light gray, unctuous material, wholly free from grit or pyrites, easily cut with a knife and very plastic when ground and moistened. Sample paving brick have been made from it, which were very tough and almost non-absorbent. The shale, according to analysis by Dr. Noyes, has the following composition:

Analysis of Shale from the Old "Casto" or "Thorp" Farm, Sugar Creek Township, Vigo County.

Silica (SiO_2)	61.05	
Titanium oxide (TiO_2)	1.20	
Alumina (Al_2O_3)	21.46	
Water combined	6.94	
Clay base and sand		90.65
Ferric oxide (Fe_2O_3)	5.57	
Ferrous oxide (FeO)	.71	
Lime (CaO)	.25	
Magnesia (Mg)	.70	
Potash (K_2O)	2.34	
Soda (Na_2O)	.30	
Fluxes		9.87
Total		100.52

The analysis shows this to be a much purer and more refractory shale than the average, and it will therefore have a tendency to shrink in burning, which can be readily overcome by mixing with it some of the overlying surface clay or a shale containing more silica. This analysis may be taken as fairly representative of the average composition of the soft, gray, unctuous No. 8 shale found in the uplands west of the Wabash River.

On the Larrimer land, in the northwest quarter of section 25 (12 N., 10 W.), occurs another large outcrop of shale No. 8. It is in a ravine one-eighth of a mile northwest of the coal mines which are worked on the same land. This shale outcrops over quite an area, and can be secured by easy stripping. It is underlain with two or more veins of coal, and can be easily reached by a switch from the Vandalia, one mile distant.

Samples of this shale were made into bricks with a Boyd dry press machine, and also into paving brick for Dr. J. T. Scovell. The pressed front brick were of a rich dark reddish-brown color, uniform throughout; had a clear metallic ring, did not shrink much in burning, did not warp, and were tough, not chipping easily. Architect Floyd, of Terre Haute, said of them "that no finer brick were ever laid in Terre Haute, and that they were worth $30.00 per thousand, as well as one dollar was worth another."

The paving bricks shrunk considerably in burning, but did not warp. They were hard and tough and absorbed but little moisture. One of them, tested for strength by Prof. M. A. Howe, at the Rose Polytechnic shops, gave the following results:

"*A brick from Vigo County shale—Cross breaking test.*—Area of cross section 8.49 inches, supported on knife edges six inches apart; the force applied by knife edge midway between the supports, using the Riehle testing machine. The brick broke under a pressure of 6,040 pounds, showing a strength per square inch of 2,900 pounds. In the compression test the brick was on cast-iron supports, with pine bedding. Area, 6.27 inches. The specimen cracked at 88,000 pounds and failed at 95,500 pounds, showing a strength per square inch of 15,230 pounds. A brick made from the bottom land clay used by the Terre Haute Pressed Brick Company, when subjected to the same tests, showed a cross breaking strength of 1,300 pounds per square inch and a compression strength of 11,940 pounds per square inch. Another, composed of one-third shale from section 25 and two-thirds bottom land clay, showed a cross-breaking strength of 1,700 pounds per square inch."*

On the land of G. A. Harris, southwest of the southeast quarter of section 25 (21 N., 10 W.), the following strata are to be seen in a ravine a short distance northwest of the barn:

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*Scovell, Geol. of Vigo Co., 21st Ann. Rep., p. 569.

Section on Land of G. A. Harris.

	Feet.	Inches.
1. Soil and surface clay	2	0
2. Limestone, flinty, fossiliferous	3	0
3. Soft blue shale	7	4
4. Limestone in thin layers	1	0
5. Sandy shale	8	0
6. Soft blue shale	2+	0

No. 3, here exposed, is evidently No. 8 of the general section along Sugar Creek. Near the middle of the stratum is a band of reddish purple shale a foot or so thick, which weathers into small lenticular fragments. When ground and moistened it is very plastic and tough, and would make a good modeling clay. The limestone No. 2 has been quarried to some extent for macadam. No. 6 is exposed in several places 150 yards farther down the bed of the stream leading from the ravine. It is the No. 12 of the general section, and is doubtless of good, workable quality and thickness.

On the old Butz farm, now owned by the G. W. Harris estate, at the slope shaft of the West Terre Haute Coal Company, in the southwest of the northeast of section 25 (12 N., 10 W.), the following strata are exposed:

Section on G. W. Harris Estate.

	Feet.	Inches.
1. Soil and surface clay	2	0
2. Buff to drab sandy shale	28	0
3. Soft blue clayey shale	22	0
4. Sheety shale and bone coal	0	10
5. Coal VII	5	2
6. Under-clay in sump	6	8

Nos. 2, 3 and 6 of the section are all of them of good quality, capable of being made into many kinds of vitrified products. No. 2 by itself is best suited for ordinary or dry pressed brick. Mixed with No. 3, it will add to the quality for paving brick or sewer pipe. This exposure is two and three-quarter miles a little south of west of the court house at Terre Haute, and seven-eighths of a mile south of the Vandalia Railway. A spur to reach it would have to cross Sugar Creek, but otherwise the expense would not be above the average for such distance. The same strata will be found close to the surface over the 40 acres just west, viz., the southeast of the northwest of section 25. Coal VII, as here mined, is of excellent quality, being much freer from sulphur than at some of the mines farther north.

The above constitute all of the clay deposits visited west of the Wabash River. The three large factories already in operation have fully tested the shales and under-clays and have proven their fitness for making almost every kind of vitrified ware used in the State. Other tests have shown them highly suitable for terra cotta, pressed front brick and ordinary brick. The under-clays, when properly washed, will also make a good quality of stoneware. Coal VII, five feet thick, is within 50 to 80 feet of the surface, and is mined at a number of places; coal VI, 270 feet below the surface, is six feet thick, and mined at the Deep Vein shaft, near the plant of the National Drain Tile Company. Other veins of coal of workable thickness occur below this. Three railways pass through this area and another is graded to within its border. Water in abundance can be had for the pumping. With all these factors present, it is safe to predict that within ten years clay factories of large size will be in sight of one another on the west bluffs of the Wabash from below West Terre Haute northward to Clinton and beyond.

From the alluvial or sedimentary clays, found in the lowlands or flood plain of the Wabash River, ordinary soft mud brick are made by a number of factories in the city of Terre Haute. These factories are located along the western border of the eastern river terrace, and the clays used are obtained 100 to 400 yards west and about 35 feet below the level of the yards. The clay has been deposited where found by the high waters of the annual overflows. Its thickness has never been determined, but it is known to be more than 20 feet. It is very fine in texture, and, for a river bottom clay, remarkably free from pebbles and coarser impurities. It shrinks but little in burning, and forms a strong and durable brick, which, on a large scale, can be made for a little less than $3.00 per thousand, and usually bring $6.50 delivered in the city, the average cost of delivery being about 55 cents per thousand. Some of these common soft mud brick, made from bottom land clay in the south part of Terre Haute, and burned hard, showed, in tests made at the Rose Polytechnic, a cross breaking strength of 570, 540, 890 and 920 pounds per square inch, and a compression strength of 1,410 and 2,010 pounds per square inch. A brick two-thirds shale and one-third bottom-land clay showed a cross breaking strength of 1,200 and a compression strength of 5,070 pounds per square inch.

For a time dry-pressed-front brick were made from this river bottom clay. They were very hard and smooth, but the clay had a tendency to burn into different colors. This necessitated much labor in the assorting of the finished product. No less than thirteen different shades were gotten from each kiln. This was doubtless due, in part, to the non-uniformity of chemical composition, which such a clay must, of necessity, possess, but more largely to the variations of the burning and position in the kiln. Nevertheless, by careful assortment, the company was successful in getting a good percentage of first-class brick, and the "seconds" sold readily at fair prices for sidewalks and foundations. The clay, coming, as it did, from the river bottoms, was quite full of moisture, and an artificial dryer was erected. This did not prove a success, and the plant was finally changed into one for making ordinary brick.

At Middleport, Ohio, similar sedimentary clays from the lowlands of the Ohio River are used by two large factories for the making of vitrified brick. They present the cheapest form of clay which can be used for paving material, as they can be dug by steam shovel for a nominal cost, and the labor necessary to prepare them for use is almost nothing. On the other hand, the excessive plasticity of the material is against it, as it is difficult to prevent faults of structure in forming the brick.

The analysis of the Terre Haute clay (Noyes, chemist) is here given side by side with that of a similar sedimentary clay from the lowlands of the Ohio River, near Columbia, Ohio, and which, according to Orton, "was worked into vitrified wares of high grade."

Analyses of Alluvial Clays from Terre Haute, Ind., and Columbia, Ohio.

	Terre Haute.	*Columbia.*
Silica (SiO_2) (total)	66.11	63.73
Alumina (Al_2O_3)	13.78	17.17
Water combined	6.34	4.90
Clay base and sand	86.23	85.80
Ferric oxide (Fe_2O_3)	5.35	5.85
Lime (CaO)	1.67	.58
Magnesia (MgO)	1.78	.97
Potash (K_2O)	2.11	2.33
Soda (Na_2O)	1.15	.67
Fluxes	12.06	10.40

The physical tests above mentioned show that brick from the Wabash alluvial clay did not rank well as compared with those made of the shale west of the river. The method of preparation and burning the sample brick might have had much to do with the low results obtained, as that method was doubtless the same as for shale brick. The chemical analysis above given shows nothing present which would affect the vitrification of the clay under the proper burning.

Township 11 North, Ranges 8 and 9 West.

In this area occur the principal clay deposits of Vigo County, east of the Wabash River. Township 8 west corresponds to Riley, and 9 west to Honey Creek of the civil townships. The area is drained by Honey Creek, which flows a little south of west across the two townships, and receives numerous small tributaries from the north and south. Three railways, the E. & T. H., the E. & I. and S. I., cross the region and furnish the best of transportation facilities. Coal VII occurs over the northern half and southwestern corner of Riley, and the northeastern corner and southern half of Honey Creek, and the shales above this coal form the most valuable clay resources of the two townships. In section 31, in the southwestern corner of Riley, this shale is 50 feet or more in thickness.

One mile northwest of Riley, on the land of the J. M. Sankey estate, northeast quarter of section 17 (11 N., 8 W.), the E. & I. Railway runs by the side of a large deposit of soft, gray, clayey shale. This is more than 20 feet thick, and lies above coal VII and VIb, the latter at this point being five to six feet in thickness and mined less than one-fifth of a mile to the southeast. The shale has been exposed in numerous places along the grade of the railway and, on the hill to the west, has but about two feet of soil and yellow surface clay above it. It is also exposed in the ditches along the Terre Haute and Riley road just to the east, and underlies the greater part of the D. M. Wallace farm on the east side of that road, the Wallace house standing on an elevation of the shale.

This shale is very free from silica and other impurities, and can be made into all kinds of vitrified products, terra cotta and dry pressed brick. With a railway already in place and good coal beneath it, it offers a most excellent site for the location of a clay-working factory.

At the Fisk mine, on the southwest corner of the Wallace farm, coal VIb, of fine quality, being free from sulphur and burning to a white ash, is mined at a depth of 50 feet. A section of the shaft of the mine shows:

Section of Shaft of Fisk Mine, One Mile Northwest of Riley.

		Feet.	*Inches.*
1.	Soil and surface clay	4	0
2.	Blue gray clayey shale	8	0
3.	Gray sandy shale	3	6
4.	Coal VII	1	6
5.	Under-clay	1	8
6.	Coal VII	1	6
7.	Under-clay	4	0
8.	Black bituminous shale	1	8
9.	Sandstone	3	0
10.	Limestone	4	0
11.	Black sheety shale	12	0
12.	Coal VIb	5	0
13.	Under-clay	10	0

Not over three acres of the coal have as yet been worked out by the present operators, who pay 8 cents per ton royalty. The shales 2 and 3 and the under-clays 5, 7 and 13, aggregating 27 feet, are all workable products, and should be used in connection with the coal. Coal VII, here represented by two veins, separated by 20 inches of under-clay, could be mined with profit if the intervening clay were utilized.

Two miles west of Riley, on the southwest quarter of 18 and the northwest quarter of 19 (11 N., 8 W.), and on the northeast quarter of section 24 (11 N., 9 W.), there are outcrops of the shale overlying coal VII on the lands of B. Franklin, Spencer & Hazelton and W. Fair. These exposures were made while grading the east-west road that passes between the quarter sections mentioned. They are 3 to 12 feet in thickness, with 1 to 7 feet of yellow surface clay above and bottom hidden. The shale is drab to buff in color, but will be found blue at greater depths. It will make all grades of vitrified wares and dry pressed and ordinary brick. The Southern Indiana Railway passes between the outcrops and within 350 feet of all of them, while one or more workable veins of coal will be found below them.

On the N. Jones farm, in the northwest of the northeast section 18 (11 N., 8. W.), a bore in search of coal passed through 52 feet of blue clayey shale (soapstone) in the first 71 feet drilled. Coal VIb, four feet in thickness, overlying seven feet of a good grade of under-clay, was found at a depth of 117 feet.

On the old "Tuller" farm, in the northwest quarter of section 13 (11 N., 9 W.), is a bluff of shale 30 feet in thickness. The point where found is only one-quarter of a mile east from the E. & I. and S. I. Railways and one-half mile from the E. & T. H. Railway. A valley along which a switch could be easily constructed leads to all three. The shale is of good quality and contains a higher percentage of free silica than at the Sankey deposit near Riley, but not too much. Coal has not been found here, but borings will undoubtedly show the presence of one or two workable veins below the shale. A dam across Little Honey Creek, on which the outcrops occur, would insure a plentiful supply of water.

Of this Tuller deposit Dr. Scovell wrote:* "Specimens taken so as to represent the average of the bluff, both sand and shale, were sent to H. S. Grimes, Portsmouth, Ohio, who had them made into 'Hallwood block' pavers. When he sent the brick to me Mr. Grimes wrote 'that there never was a better brick made.' They were of a rich brown color and apparently in every way a first-class brick. They were considerably lighter than the ordinary block and somewhat larger, as they did not shrink in burning."

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*Geol. of Vigo Co., 1896, p. 570.

On the O. S. Smith land, in the northeast quarter of section 36 (11 N., 9 W.), is an exposure of good shale 12 feet or more in thickness, above the creek. Coal VII occurs a few feet below it, and is mined on the J. W. Smith farm, just to the west. On South Honey Creek, in the northwest quarter of section 25 (11 N., 9 W.), occurs a fine outcrop of shale, and on the same creek, in the southwest quarter of section 24, within one-half mile of the E. & T. H. Railway, is another exposure.

The above constitute the principal visible deposits in Riley and Honey Creek townships. A number of them well merit development, as all the necessary factors for a successful clay manufactory are present.

Township 10 North, Ranges 8 and 9 West.

Coal VII, with is overlying shales, overlies the west half of 10 north, 8 west (Pierson Township), and the east half of 10 north, 9 west (Linton Township). The Southern Indiana Railway runs northeast and southwest diagonally across Pierson, and the E. & T. H. north and south through the eastern third of Linton.

On the northwest quarter of section 6 (10 N., 8 W.), Pierson Township, there is a fine cliff of shale, known as the "Paint Mine." It is distant a mile and a quarter west from the Southern Indiana and one and three-quarters miles east of the E. & T. H. Railways. For a number of years the shale was pulverized, barreled and shipped to different parts of the country to be used as a body for paints. The company worked under difficulties of various kinds, but no fault was ever found with the material it sent out. Coal VII is reported to lie 32 feet below the Paint bank, and to be 18 inches thick. As there is 15 to 20 feet of shale over the Paint bank, there is indicated a thickness of about 50 feet of a fine grade of shale.

On the north side of the road which runs by the "mine" the shale is exposed above the water in South Honey Creek to a thickness of 19 feet, with 3 to 9 feet of surface clay above it.

Near the bottom of the exposure are two or three thin bands of ironstone concretions. At the worked opening on the south side of the road the cover of yellow clay is 10 to 13 feet and the shale 16½ feet thick. At this point, in August, 1904, the shale had weathered into cubical blocks, two to five inches in size, with few or no iron nodules visible. It is of a light gray color. very fine-grained and uniform in composition, and forms one of the finest exposures seen anywhere in the State. Mr. W. P. Blair, of the Terre Haute Brick Company, tells me that he has burned pieces of the shale in his kilns, and that no better burning material can be found. Dr. Scovell says that "in this locality there are several ironstone bands in this shale, with many nodules of the same material. One owner of the quarry used to make hone stones from these clay ironstone layers that were of the finest quality. They were known as the 'Fera hone stones.' The shale from this locality makes good brick, but they are mottled gray in color. If the ironstone were crushed with the shale, the mass would doubtless make a brick of a good red color and great strength. The material would make a handsome stiff mud, repressed front brick."

The same stratum of shale outcrops in a number of places along South Honey Creek, north of the Paint Mine, forming the surface rock over the greater part of the southeastern quarter of section 31. It is also exposed in a bold bluff about a half mile south on the same stream, the quality there being fully as good as at the Paint Mine. Another good exposure occurs on the S. Hedges farm, in the southwest quarter of section 17 (10 N., 9 W.), where an outcrop of coal VIII is overlain by 20 feet of clay shale.

On the land of William Forbes, southwest quarter of section 28 (10 N., 8 W.), along a branch of Busseron Creek, is an exposure of a good quality of the shale, overlying coal VII. The point of outcrop is four miles northwest of Lewis and three-quarters of a mile north of a branch of the Southern Indiana Railway. The outcrop rises 8 to 10 feet above the stream and has a cover of four to six feet of soil and yellow surface clay. Just to the west, on the land of Theo. Walters, northeast of southeast of section 29, are several other exposures. One of these extends eight feet above the stream and is several hundred feet in length. The shale is drab to light bluish gray in color, free from grit and of fine quality for all vitrified wares, terra cotta and various kinds of brick.

Less than one-quarter of a mile to the south, on the land of Burr Hendrickson, in the southeast of the southeast of 29, a drill hole showed:

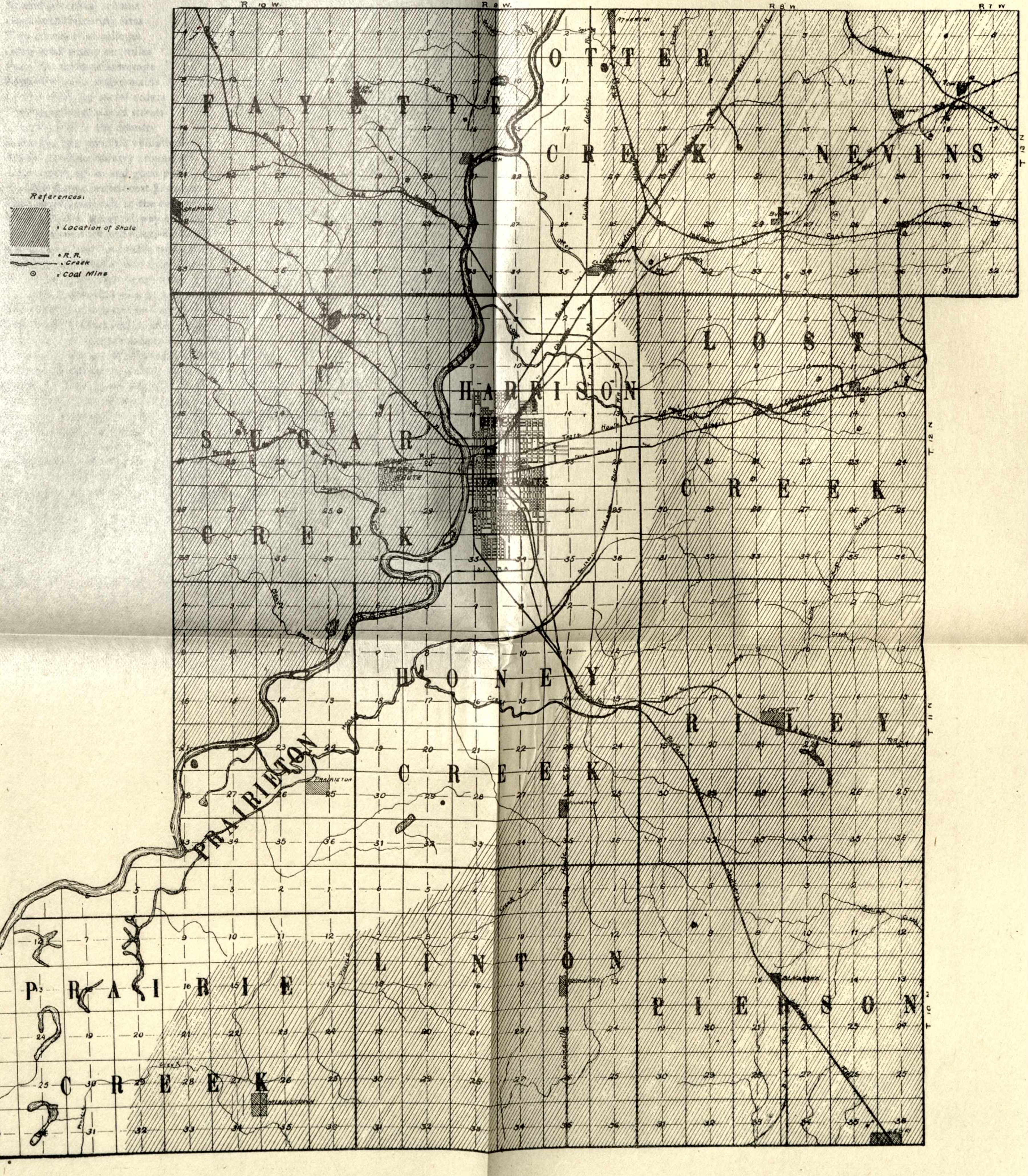
Section of Bore on Burr Hendrickson Land.

	Feet.	Inches.
1. Soil and surface clay	6	0
2. Drab to blue shale	30	0
3. Coal VII; poor quality	3	0

The thickness of the shale in this bore indicates that it will be found over quite an area in this region. Away from the streams the cover of yellow clay will run four to 10 feet, a part of which can be mixed with the shale if the latter is ever worked. Coals VI, V and IV, of workable thickness, should be found below coal VII.

The deposits of Vigo County clays above mentioned are all valuable, and a factory located at any one of them will, under normal conditions, prove a paying investment. The city of Terre Haute will doubtless maintain in the future, as it has in the past, a steady, onward growth, and will use clay products for buildings and roadways to the value of many millions of dollars. With large deposits of the raw materials suitable in the highest degree for making such products, with the best of fuel for burning these materials into their proper shapes, and with ten railways stretching in all directions, ready at a moment's notice to carry the surplus to less favored cities, there is no reason why the clay industry should not soon take front rank among the varied manufacturing interests of the county.

MAP
showing the
SHALE · DISTRICTS
in
VIGO COUNTY
INDIANA



Terre Haute
Has

Two belt railroads
Two fine hospitals
Two orphans' homes
Good literary societies
Electric light and gas
Several parochial schools
Good manufacturing sites
Two commercial colleges
Glass sand within ten miles
Forty-five miles of sewerage
Forty-five miles of gas mains
Lodges of all the social orders
Twenty miles of paved streets
Cheapest coal in the country
A low tax rate and fair valuation
A good farming country around it
A fine opera house and good parks
A union station which cost $150,000
The lowest death rate in the country
A good electric street railway system
Clay for stoneware and encaustic tiling
An educated and hospitable population
Plenty of good timber within easy reach
Built 1,000 houses per year for four years
Two trust companies with $1,000,000 assets
Five banks whose assets are over $6,000,000
Sixty miles of water mains, and 780 hydrants
Coal mines on all railroads entering the city
A bridge across the Wabash which cost $271,000
A larger freight tonnage than any city in Indiana
A paid fire department and the best fire protection
The Indiana State Normal School with an enrollment of 1,600
Good city buildings and the handsomest court house in Indiana
Rose Polytechnic Institute, one of the best in its line anywhere
An inexhaustible supply of the best shale within two miles of town
A handsome public library, the gift of one of its citizens, which cost $50,000
Nineteen building and loan associations with assets amounting to $3,500,000
Twenty-one city school buildings, which cost $516,000 and are attended by 8,000 pupils
Surrounding it 2,307 square miles of coal lands, containing 3,115,000,000 tons of workable coal